PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark Office
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in its capacity as elected Office

Date of mailing (day/month/year) 25 June 1998 (25.06.98)	
International application No. PCT/EP97/06103	**Applicant's or agent's file reference** PC222PR
International filing date (day/month/year) 05 November 1997 (05.11.97)	**Priority date** (day/month/year) 05 November 1996 (05.11.96)
Applicant BASTIOLI, Catia et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

05 June 1998 (05.06.98)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer I. Britel
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

Bee 30

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

RAMBELLI, Paolo
JACOBACCI & PERANI S.p.A.
Corso Regio Parco 27
I-10152 Torino
ITALIE

RICEVUTO
25 GEN. 1999
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NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	22.01.99
Applicant's or agent's file reference PC222PR	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP97/06103 ✓	05/11/1997 ✓	05/11/1996 ✓

Applicant
NOVAMONT S.p.A. et al. ✓

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Connolly, M Tel. (+49-89) 2399-8021

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

27 JAN 1999

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416)
PC222PR		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP97/06103	05/11/1997	05/11/1996
International Patent Classification (IPC) or national classification and IPC		
C08L67/02		
Applicant		
NOVAMONT S.p.A. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☒	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☒	Certain defects in the international application
VIII	☒	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
05/06/1998	22.01.99
Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Andriollo, G Telephone No. (+49-89) 2399-8301

Form PCT/IPEA/409 (Cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP97/06103

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-44 as originally filed

Claims, No.:

1-22 as received on 07/12/1998 with letter of 04/12/1998

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 20-22 .

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 20-22.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-19
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Point V.

1. The following documents are cited in the search report. The numbering will be adhered to in the rest of the procedure :
   D1 : WO 95/24447
   D2 : EP-A-0596437

2. The present application does not satisfy the criterion set forth in Article 33(3) PCT because the subject-matter of claims 1-19 does not involve an inventive step in respect of prior art as defined in the regulations in view of D1 or D2 (Rule 64(1)-(3) PCT).

2.1 Document D1, closest state of the art, relates to biodegradable polymeric compositions, in which the polymer is the continuous phase and starch is the discontinuous phase. Said compositions face the same problem as disclosed in the present application : the diffusion and loss of water (or of the plasticizer), especially in low humidity conditions, induce an embrittlement of the product (see p. 4, l. 10-16), due to the fact that the dispersed phase becomes insufficiently plasticized. In order to solve said problem, a decaglycerol tetraoleate, called stretching agent, is added to the composition (see p. 19, l. 30).
Usual plasticizers are used as well, like glycerol acetates (see p. 15, third paragraph).
The difference underlying the present application is that use is made of a compound, called "interfacial agent", which is an ester of a polyol with an acid having a dissociation constant pKa lower than 4,5 (this excludes thus compounds like glycerol acetates, as acetic acid has a pKa of 4,7, greater than 4,5).
Furthermore said interfacial agent is characterised by a hydrophilic/lipophilic balance index value (HLB) greater than 8.
However, up to now, no special and unexpected technical effect or advantage resulting from the use of these interfacial agents has been demonstrated yet by (comparative) examples in view of the polymeric compositions of D1.
The problem solved by present application can thus be considered as a way to prepare further biodegradable polymeric compositions, in which the polymer is the continuous phase and starch is the discontinuous phase, which keep good

mechanical properties even in low humidity conditions.
It would then be obvious for a skilled man, faced with the here above mentioned technical problem, to propose the alternative compositions of the present application.

2.2 Document D2 proposes the use of a macromolecular phase compatibilizer, for instance a block copolymer, which contains a part that is soluble in the starch discontinuous phase and another part which is soluble in the polymeric continuous phase (see page 4, lines 36-41 and claim 4).
On the other hand, the present application proposes the use of interfacial agents of the ester type, as they can compatibilize starch/polyester systems due to the interaction between the free alcohol groups of the ester and those of the starch and between the ester groups of the ester and the polyester phase (see description p. 5, sixth paragraph).
Here again, the difference underlying the present application compared to D2, namely the use of specific ester rather than a block copolymer, should bring unexpected effects or advantages in view of D2.
In absence of comparative tests and examples showing an improvement in view of D2, the technical problem solved by the present application is to be considered as to provide alternative biodegradable polymeric compositions, which are capable of maintaining their mechanical characteristics even in low humidity conditions.
Consequently no contribution for the assessment of an inventive step can be acknowledged.

Point VII.

1. In the description p. 23, the cited document WO 93/07123 should probably read WO 93/07213.

2. Furthermore, contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

Point VIII.

The present application does not satisfy the criterion set forth in Article 6 PCT because the following claims are unclear.

1. In claims 10 and 11 the plasticizer is not to be distinguished with the interfacial agent. Therefore it is suggested to add a sentence like the one in the description, page 10, fourth paragraph, where it is clear that the acids used for the plasticizers are different than the one used for the esters of the interfacial agent.

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: BIODEGRADABLE POLYMERIC COMPOSITIONS COMPRISING STARCH AND A THERMOPLASTIC POLYMER

(57) Abstract

Polymeric compositions comprising thermoplastic starch and a thermoplastic polymer incompatible with starch, in which the starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase, selected: A) from compositions comprising an agent with an interfacial effect selected from esters of polyols with mono– or polycarboxylic acids with dissociation constants within certain limits, the esters having specific values of the hydrophilic/lipophilic balance index HLB or being amongst the non–ionic surfactants which are soluble in water but cannot significantly be extracted by water from the compositions which contain them; B) from compositions wherein the thermoplastic polymer is an aliphatic or aliphatic–aromatic copolyester wherein the ratio (R) between the average viscometric molecular weight and the melt index is greater than 25,000 and C) from compositions wherein the thermoplastic polymer is selected from aliphatic–aromatic copolyesters, polyester–amides, polyester–ethers, polyester–ether–amides, polyester–urethanes and polyester–ureas and wherein the compositions are obtained by extrusion of the component maintaining a water content during the mixing stage from 1 to 5 % by weight.

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CLAIMS

1. Biodegradable heterophase polymeric compositions having good resistance to ageing and to low humidity conditions, comprising thermoplastic starch and a thermoplastic polymer incompatible with starch, in which starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase, containing an interfacial agent selected from the following class of compounds:

- esters of polyols with mono- or polycarboxylic acids with values of the dissociation constant pK lower than 4.5 (the value relates to the pK of the first carboxyl group in the case of polycarboxylic acids), characterised by hydrophilic/lipophilic balance index values (HLB) greater than 8.

2. A composition according to claim 1, wherein in said esters of polyols the polyols contain 3 or more carbon atoms and 2 or more alcohol groups.

3. Compositions according to claim 2, in which the polyol is glycerol.

4. Compositions according to claims 2 or 3, in which the esters are monoglycerides.

5. Compositions according to any of the preceding claims 2-4, in which the ester is an ester of oxalic, malonic, succinic, adipic, glutaric, maleic, citric, tartaric, lactic, or mono-, di-, or tri-chloroacetic acid.

6. Compositions according to claim 5, in which the ester is (on average) the monoglyceride.

7. Compositions according to any of the preceding claims 1 to 6, in which the ratio by weight between the thermoplastic starch and the thermoplastic polymer incompatible with starch is such that the starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase.

8. Compositions according to any of the preceding claims 1 to 7, in which the quantities of the esters used are from 0.5 to 20% by weight relative to the total composition.

9. Compositions according to any of the preceding claims 1 to 8, comprising a plasticizer.

10. Compositions according to claim 9, in which the plasticizer is selected from polyols with 3 or more carbon atoms and with 2 or more alcohol groups, the polyols possibly being etherified or esterified.

11. Compositions according to claim 10, in which the polyol is selected from glycerol, sorbitol, etherified or esterified sorbitol, ethyleneglycol and trimethylolpropane.

12. Compositions according to any of claims 9 to 11, in which a quantity of plasticizer of from 1 to 100% by

weight relative to the starch is used.

13. Compositions according to any of the preceding claims, in which the ester is used in a ratio of from 1:30 to 1:2.5 by weight to the starch.

14. Compositions and materials according to any of the preceding claims, in which the thermoplastic polymer is selected from aliphatic or aliphatic-aromatic polyesters obtainable by polycondensation of hydroxyacids with 2 or more carbon atoms, or from the corresponding lactones or lactides, or by a polycondensation of a diol with 1-12 carbon atoms with a dicarboxylic aliphatic acid or with mixtures thereof with dicarboxylic aromatic acids.

15. Compositions according to claim 14, in which the polymer is a poly-ε-caprolactone.

16. Films as obtainable from the compositions of any of claims 1 to 6.

17. Use of the film according to claim 16 in the manufacture of nappies, of sanitary towels, of bags, of laminated paper, of laminates and of films treated with inorganic products, such as silica and aluminium.

18. Use of the films of claim 16 in the agricultural field and for cellophaning.

19. Use of the compositions according to any of claims 1

to 15 for the manufacture of expanded materials usable in packaging and of disposable articles.

20. A material as obtainable from heterophase compositions comprising thermoplastic starch and a thermoplastic polymer incompatible with starch, in which the starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase, characterised by a microstructure of the dispersed phase in which at least 80% of the particles have dimensions smaller than 1 µm.

21. A material according to claim 20, in which the average numeral particle size is between 0.1 and 0.5 µm.

22. A material according to claims 20 or 21 in film form.

CLAIMS

1. Biodegradable heterophase polymeric compositions having good resistance to ageing and to low humidity conditions, comprising thermoplastic starch and a thermoplastic polymer incompatible with starch, in which starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase, selected from:

A) compositions containing an interfacial agent selected from the following classes of compounds:

a) esters of polyols with mono- or polycarboxylic acids with values of the dissociation constant pK lower than 4.5 (the value relates to the pK of the first carboxyl group in the case of polycarboxylic acids), characterised by hydrophilic/lipophilic balance index values (HLB) greater than 8;

b) esters of polyols with mono- or polycarboxylic acids with less than 12 carbon atoms and with pK values greater than 4.5 and having HLB indices between 5.5 and 8;

c) esters of polyols with C_{12}-C_{22} fatty acids having HLB indices lower than 5.5, the esters being used in quantities of from 10 to 40% by weight of the starch;

d) non-ionic, water-soluble surfactants which, when added to the starch/thermoplastic polymer compositions indicated above, migrate in water by no more than 30% wt of their concentration after the material containing them has been immersed in water for 100 hours at ambient temperature,

e) reaction products of an aliphatic or aromatic diisocyanate with a polymer containing terminal groups reactive with the diisocyanates;

B) compositions wherein the thermoplastic polymer incompatible with starch is a polyester comprising repeating units deriving from hydroxyacids with more than 2 carbon atoms and/or from aliphatic dicarboxylic acids, and in which the ratio R between the average viscosimetric molecular weight and the melt index (measured at 180°C under a 5 kg load) is

greater than 25,000.

C) compositions wherein the thermoplastic polymer incompatible with starch is selected from the group consisting of aliphatic-aromatic copolyesters, polyester-amides, polyester-ethers, polyester-ether-amides, polyester-urethanes and polyester-ureas, said compositions being obtained by extrusion under conditions wherein the content of water during the mixing of the components is maintained from 1 to 5% by weight (content measured at the exit of the extruder, prior to any conditioning).

2. A composition according to Claim 1, wherein the composition is selected from the group A) compositions and wherein the esters are obtained from polyols containing 3 or more carbon atoms and 2 or more alcohol groups.

3. Compositions according to Claim 2 in which the polyol is glycerol.

4. Compositions according to Claims 2 or 3 in which the esters are monoglycerides.

5. Compositions according to preceding Claims 2-4, in which the ester a) is an ester of oxalic, malonic, succinic, adipic, glutaric, maleic, citric, tartaric, lactic, or mono-, di-, or tri-chloroacetic acid.

6. Compositions according to Claim 5 in which the ester a) is (on average) the monoglyceride.

7. Compositions according to Claims 2-4, in which the ester b) is obtained from caproic, suberic, or azelaic acid.

8. A composition according to Claim 7 in which the ester

is, on average, the monoglyceride.

9. Compositions according to Claims 2-4, in which the ester c) is, on average, the monoglyceride of lauric or oleic acid.

10. Compositions according to Claim 2, in which the surfactant d) is selected from alkoxylated substituted alkyl phenols with HLB indices greater than 10.

11. Compositions according to the preceding claims 2 to 10 in which the ratio by weight between the thermoplastic starch and the thermoplastic polymer incompatible with starch is such that the starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase.

12. Compositions according to preceding Claims 2-9 in which the quantities of the esters a) and b) used are from 0.5 to 20% by weight relative to the total composition.

13. Compositions according to the preceding claims 2 to 12, comprising a plasticizer.

14. Compositions according to Claim 13, in which the plasticizer is selected from polyols with 3 or more carbon atoms and with 2 or more alcohol groups, the polyols possibly being etherified or esterified.

15. Compositions according to Claim 14, in which the polyol is selected from glycerol, sorbitol, etherified or esterified sorbitol, ethylene glycol, and trimethylol propane.

16. Compositions according to Claims 12 to 15, in which a quantity of plasticizer of from 1 to 100% by weight

relative to the starch is used.

17. Compositions according to Claim 16, in which the ester a) or b) is used in a ratio of from 1:30 to 1:2.5 by weight to the starch.

18. Compositions and materials according to the preceding claims, in which the thermoplastic polymer is selected from aliphatic or aliphatic-aromatic polyesters obtained by polycondensation of hydroxy-acids with 2 or more carbon atoms, or from the corresponding lactones or lactides, or by polycondensation of a diol with 1-12 carbon atoms with a dicarboxylic aliphatic acid or with mixtures thereof with dicarboxylic aromatic acids.

19. Compositions according to Claim 18 in which the polymer is a poly-epsilon-caprolactone.

20. A composition according to Claim 1, wherein the composition is selected from the group B) compositions and the R ratio is between 40,000 and 110,000.

21. Compositions according to Claim 20, in which the polyester is the product of the polycondensation of an aliphatic dicarboxylic acid with a diol with 2 or more carbon atoms, or the polycondensation product of an aliphatic hydroxy-acid with more than 2 carbon atoms or of a lactone or lactide thereof.

22. A composition according to Claim 21, in which the polyester contains units derived from an aromatic dicarboxylic acid and/or from a mixture of aliphatic dicarboxylic acids or of hydroxy-acids.

23. Compositions according to preceding Claims 21-22, in

which the polyester is poly-epsilon-caprolactone, poly-epsilon-caprolactone/epsilon-caprolactam, poly-epsilon-caprolactam/butylene adipate.

24. Compositions according to Claim 23, in which the polycaprolactone has a mean viscometric molecular weight greater than 100000 and a R ratio of between 40,000 and 110,000.

25. Compositions according to the preceding claims 21-24 comprising a plasticiser selected from polyols with 3 or more carbon atoms.

26. Compositions according to Claim 25, in which the polyol is selected from glycerol, sorbitol, trimethylol propane and pentaerythritol.

27. Compositions according to Claims 25 and 26, in which the quantity of polyol used is from 10 to 100% relative to the starch.

28. A composition according to Claim 1, wherein the composition is selected from the group C) compositions, and wherein the starch is dispersed in the copolyester matrix in the form of particles having average numeral dimension less than 1 μm.

29. Compositions according to claim 28, wherein the starch particles have average numeral dimension less than 0.5 μm and more than 70% of the particles have dimension less than 0,5 μm.

30. Compositions according to claims 28-29 wherein the copolyester is obtained by polycondensation of mixtures of dicarboxilic aromatic and aliphatic acids with an aliphatic

C_2-C_{20} diol.

31. Compositions according to Claim 30, wherein the aliphatic dicarboxilic acid is selected from the group consisting of adipic, glutaric and sebacic acids and the aromatic acid is terephthalic acid.

32. Compositions according to Claims 28-30, wherein the copolyester is obtained by polycondensation of an aliphatic C_2-C_{20} diol with a mixture of a hydroxyacid with more than 2 carbon atoms or the corresponding lactone with terephthalic acid.

33. Compositions according to claims 28-32, wherein the copolyester is selected from the group consisting of polyalkylen adipate-polyalkyleneterephthalate, polyalkylen-adipate-polyalkylenisophthalate and polyalkylensebacate - polyalkyleneterephthalate.

34. Compositions according to claims 28-33 wherein the content of units having an aliphatic structure is comprised from 30 to 70% by mols.

35. Compositions according to claim 28 wherein the copolyester-amide is selected from the group consisting of poly-epsilon-caprolactone-epsilon-caprolactam, poly-alkylenadipate-epsilon-caprolactam and polyalkylenesuccinate- epsilon-caprolactam.

36. Compositions according to claims 26 to 35, wherein the content of starch is comprised from 5 to 95% by weight and the content of the copolyester is from 95 to 5% by weight.

37. Compositions according to claims 28 to 36 comprising a plasticiser selected from the group consisting of glycerol,

sorbitol, polyglycerol, esters and ethers of glycerol, sorbitol and polyglycerol; 1,3-propandiol and pentaerythritol.

38. Compositions according to claims 28 to 37 comprising a polymer selected from an aliphatic polyester, cellulose acetates, ethylene-vinylalcohol copolymers, ethylene-vinylacetate copolymer and polyvinylalcohol in an amount up to 30% by weight of the composition.

39. Process for preparing a composition according to the preceding claims 28 to 38, comprising extruding the components of the composition under conditions wherein the content of water is maintained from 1 to 5% by weight during the mixing of the components.

40. A film obtained from the compositions from claims 28-38.

41. Use of the films according to claim 40 in the manufacture of nappies, of sanitary towels, of bags and of laminated paper.

42. Use of the films according to claim 40 in the agricultural field for mulching application.

43. Use of the compositions of claims from 28 to 39 for the manufacture of expanded molded articles usable in packaging, and of disposable articles.

44. Films obtained from the compositions A) and B) of claim 1 or from the compositions of claims 2 to 27.

45. Use of the film according to Claim 44 in the manufacture of nappies, of sanitary towels, of bags, of laminated paper, of laminates, and of films treated with inorganic

products such as silica and aluminium.

46. Use of the films of Claims 44 in the agricultural field and for cellophaning.

47. Use of the compositions A) and B) of claim 1 and of the compositions of the preceding claims 2 to 27 for the manufacture of expanded materials usable in packaging, and of disposable articles.

48. A material produced from heterophase compositions comprising thermoplastic starch and a thermoplastic polymer incompatible with starch, in which the starch constitutes the dispersed phase and the thermoplastic polymer constitutes the continuous phase, characterized by a microstructure of the dispersed phase in which at least 80% of the particles have dimensions smaller than 1 μm.

49. A material according to Claim 48 in which the average numeral particle size is between 0.1 and 0.5 μm.

50. A material according to Claim 48 and 49 in film form.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

To:

RAMBELLI, Paolo
Jacobacci & Perani S.p.A.
Corso Regio Parco, 27
I-10152 Torino
ITALIE

01 GIU. 1998

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year) 14 May 1998 (14.05.98)	
Applicant's or agent's file reference PC222PR	**IMPORTANT NOTICE**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/EP97/06103	05 November 1997 (05.11.97)	05 November 1996 (05.11.96)

Applicant
NOVAMONT S.P.A. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,BR,CA,CN,EP,IL,JP,KP,KR,NO,PL,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AL,AM,AP,AT,AZ,BA,BB,BG,BY,CH,CU,CZ,DE,DK,EA,EE,ES,FI,GB,GE,GH,HU,ID,IS,KE,KG,KZ, LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NZ,OA,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR, TT,UA,UG,UZ,VN,YU,ZW
   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   14 May 1998 (14.05.98) under No. WO 98/20073

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, **a demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

The demand must be filed directly with the competent International Preliminary Examining Authority, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ _____

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: PC222PR

International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/EP97/06103	05 November 1997 (05.11.1997)	05 November 1996 (05.11.1996)

Title of invention: "Biodegradable polymeric compositions comprising starch and a thermoplastic polymer"

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

NOVAMONT S.p.A.
Via Fauser 8
I-28100 NOVARA (Italy)

Telephone No.:

Facsimile No.:

Teleprinter No.:

State *(i.e. country)* of nationality: IT

State *(i.e. country)* of residence: IT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BASTIOLI, Catia
Via della Noce 63
I-28100 NOVARA (Italy)

State *(i.e. country)* of nationality: IT

State *(i.e. country)* of residence: IT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BELLOTTI, Vittorio
Via Mora e Gibin 9
I-28010 FONTANETO D'AGOGNA (Novara) Italy

State *(i.e. country)* of nationality: IT

State *(i.e. country)* of residence: IT

[X] Further applicants are indicated on a continuation sheet.

International application No.
PCT/EP97/06103

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet is not to be included in the demand.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

CELLA, Gian Domenico
Via Minghetti 1
I-28100 NOVARA (Italy)

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
IT	IT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

DEL GIUDICE, Luciano
Piazzale Siena 4
I-20146 MILANO (Italy)

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
IT	IT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MONTINO, Sandro
Via Bellotti 15
I-27038 ROBBIO LOMELLINA (Pavia) Italy

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
IT	IT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

PEREGO, Gabriele
Via Voghera 20
I-20144 MILANO (Italy)

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
IT	IT

☐ Further applicants are indicated on another continuation sheet.

International application No.
PCT/EP97/06103

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is [X] agent [ ] common representative

and [X] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

[ ] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

RAMBELLI, Paolo (IT)
c/o JACOBACCI & PERANI S.p.A.
Corso Regio Parco 27
I-10152 TORINO (Italy)

Telephone No.: (39) (11) 2440311

Facsimile No.: (39) (11) 286300 / 286676

Teleprinter No.:

[ ] Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV STATEMENT CONCERNING AMENDMENTS

The applicant wishes the International Preliminary Examining Authority*

(i) [X] to start the international preliminary examination on the basis of the international application as originally filed.

(ii) [ ] to take into account the amendments under Article 34 of

- [ ] the description (amendments attached).
- [ ] the claims (amendments attached).
- [ ] the drawings (amendments attached).

(iii) [ ] to take into account any amendments of the claims under Article 19 filed with the International Bureau (a copy is attached).

(iv) [ ] to disregard any amendments of the claims made under Article 19 and to consider them as reversed.

(v) [ ] to postpone the start of the international preliminary examination until the expiration of 20 months from the priority date unless that Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Box No. V ELECTION OF STATES

[X] The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)* except .....

(If the applicant does not wish to elect certain eligible States, the name(s) or country code(s) of those States must be indicated above.)

Sheet No. 4.

International application No.
PCT/EP97/06103

Box No. VI CHECK LIST

The demand is accompanied by the following documents for the purposes of international preliminary examination:			For International Preliminary Examining Authority use only: received	not received
1. amendments under Article 34				
description	:	sheets	☐	☐
claims	:	sheets	☐	☐
drawings	:	sheets	☐	☐
2. letter accompanying amendments under Article 34	:	sheets	☐	☐
3. copy of amendments under Article 19	:	sheets	☐	☐
4. copy of statement under Article 19	:	sheets	☐	☐
5. other *(specify)*:	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. ☐ separate signed power of attorney
2. ☐ copy of general power of attorney
3. ☐ statement explaining lack of signature
4. ☒ fee calculation sheet
5. ☐ other *(specify)*:

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

RAMBELLI, Paolo

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

See Notes to the demand form

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
PC222PR		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/EP 97/06103	05/11/1997	05/11/1996
Applicant		
NOVAMONT S.P.A. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (see Box I).

2. [X] **Unity of invention is lacking** (see Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] Transcribed by this Authority

4. With regard to the **title,**
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:
   Figure No. _____
   - [ ] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [X] None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 97/06103

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See separate sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-4,9,11,13-16,18,19,44-47

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/

1. Claims 1-6, 11-19, 44-47 referring to the case when interfacial agent is (a), the film therefrom and its use

2. Claims 1-4, 7, 8, 11-19, 44-47 referring to the case when interfacial agent is (b), the film therefrom and its use

3. Claims 1-4, 9, 11, 13-16, 18, 19, 44-47 referring to the case when interfacial agent is (c), the film therefrom and its use

4. Claims 1, 10, 11, 13-16, 18, 19, 44-47 referring to the case when interfacial agent is (d), the film therefrom and its use

5. Claims 1, 18, 19, 44-47 referring to the case when interfacial agent is (e), the film therefrom and its use

6. Claims 1, 20-27, 44-47 referring to the case when the thermoplastic polymer is selected from the group B, the film therefrom and its use

7. Claims 1, 28-43 referring to the case when the thermoplastic polymer is selected from the group C, its production process , the film produced therefrom and its use

8. Claims 48-50 referring to a material produced from heterophase compositions comprising thermoplastic starch and a thermoplastic polymer incompatible with starch, characterized by a microstructure of the dispersed phase in which at least 80 % of the particles have dimensions smaller than 1 µm, comprised between 0,1 and 0,5 µm, and the material being in film form.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 97/06103

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C08L67/02 C08L67/04 C08L3/00 C08J5/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C08L C08J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 24447 A (MICHIGAN STATE UNIVERSITY) 14 September 1995 see page 4, line 11 - line 26 see page 5, line 25 - line 30 see page 7, line 25 - line 32 see page 19, line 21 - line 35 ---	1,2,11, 13-16, 18,19, 44-47
X	EP 0 596 437 A (FLUNTERA AG) 11 May 1994 see page 16, line 26 --- -/--	1-4,11, 13-16, 18,19, 44-47

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 March 1998	12 06.98

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Andriollo, G

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 92 19680 A (NOVAMONT SPA) 12 November 1992 cited in the application see page 16, paragraph 2 - paragraph 3 & US 5 412 005 A (BASTIOLI ET AL.) ---	1
A	WO 93 00399 A (PROCTER & GAMBLE) 7 January 1993 ---	1
A	EP 0 516 030 A (EMS-INVENTA) 2 December 1992 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 97/06103

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		CA 2183772 A	14-09-95
		EP 0749460 A	27-12-96
		JP 9505107 T	20-05-97
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		AT 158805 T	15-10-97
		BR 9304477 A	26-07-94
		CN 1088226 A	22-06-94
		DE 9321391 U	25-09-97
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		JP 6502676 T	24-03-94
		KR 9608112 B	20-06-96
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9219680 A		RU 2089151 C	10-09-97
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		US 5412005 A	02-05-95
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		US 5534150 A	09-07-96
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		IL 104942 A	10-06-97
		JP 6041351 A	15-02-94
		US 5462980 A	31-10-95
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		BR 9206215 A	02-05-95
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		EP 0591409 A	13-04-94
		FI 935820 A	04-02-94
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		JP 6508868 T	06-10-94
		MX 9203308 A	01-12-92
		NO 934808 A	25-02-94
		PL 173320 B	27-02-98
		PT 8542 U	31-03-93
		PT 101726 A,B	31-01-96
		SK 147693 A	07-09-94
		US 5422387 A	06-06-95
EP 516030 A	02-12-92	DE 4117628 A	17-12-92
		AU 643385 B	11-11-93
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		CA 2070041 A	30-11-92
		DE 59207696 D	30-01-97

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 516030 A		JP 2006839 C	11-01-96
		JP 5200822 A	10-08-93
		JP 7025118 B	22-03-95
		NZ 242921 A	27-04-94
		US 5316578 A	31-05-94